would be of advantage by the hold they would give to the squirming body. Then elongation would increase the advantage. No loss of this function would be necessary, but a gain, if the limb acquired some independent motion, and this might be developed enough to render it capable of officiating as the sole locomotive organ. If such a history of the limb were true, the salamander is midway in the line of descent.

3. The *post-anal region* of the salamander is piscine, while the anterior portions of the body are not, but are distinctly higher. This fact is more or less familiar in a general way and called by Professor Hyatt, who pointed it out many years ago, by the name "cephalization." This advance of the anterior part of the body of the salamander has left the "tail" to be in many respects not amphibian so much as piscine. Of course the term tail here means post-anal region of the body and the portion, roughly speaking, homologous with the post-anal region of the fish. In the higher fishes this region has acquired a "tail," while the amphibia have not shared the acquisition of a structure supported by five rays, which does not belong to the ancient vertebrate stock. In this sense the tail of the salamander and its correlate, the post anal region of the fish, are not only similar in function, being organs of locomotion, but they are comparable in their anatomy. The back-bone is acentrum with bi-concave surfaces with two equally developed arches, a neural arch containing the spinal cord, and an haemal arch containing a vein and an artery with oblique intervertebral muscles forming the back of the organ. In vertebrates above the urodela, with the loss of its locomotor function and the development of arms and legs, the post-anal region becomes of less and less importance, though not always disappearing; thus in many lizards it is large at its origin, as large as the body before it, and it has the peculiar power of *autotony*, as it has been called; that is, of breaking off in the hands of a captor, whereby the animal escapes capture. There is a gradual degeneration of the region among the higher vertebrates, with many varieties of direction and degree of development and occasional utilities in peculiar directions, and the salamander stands at the bottom of this series.

4. The *death of the salamander* is accompanied by a loss of powers of movement, which is first manifest in the last acquired (phylogenetically) of the powers, i.e., in the limbs, and finally in the vertebræ muscles. In specimens killed under the influence of chloroform, after all movement had ceased in the limbs, the sinuations of the back-bone continued for some time, and were the last movements observed to take place.

REFLEX ACTION IN TURTLES.

BY M J ELROD, ILLINOIS WESLEYAN UNIVERSITY, BLOOMINGTON, ILL.

RECENTLY I had a number of map turtles (*Malaclemys geographicus* Le Sueur) for student work, and observed, what is to me, a remarkable instance of reflex muscular action, both in the head and limbs. In one specimen the head had been severed from the body fully an hour, when I observed the students amusing themselves by tapping the nose of the severed head, when almost as quickly as in life the jaws would open, and when a pencil or other hard object was thrust in would close upon it with seemingly as much viciousness as in life, continuing to hold for some time, gradually relaxing, when the experiment would be tried over again. This was the case not only with the one in question, but with a half-dozen others of the same lot. Taking a specimen with the head cut off and all the viscera cleared away, leaving the legs attached to the carapace, the legs manifested sensitiveness to a marked degree. In one specimen the four legs extended from the body almost straight; a very gentle touch with the point of a pencil on the tip of a claw caused that leg to be drawn within the shell, so to speak, as quickly as in life. This was done alternately with each foot to the first again, all giving the same results. Several other specimens tested showed as much and as sudden movement, and one killed at 2 P.M., when touched at 11 A M. the day following, withdrew its feet instantly. While these observations are common for turtles, I have not observed such marked results in other species.

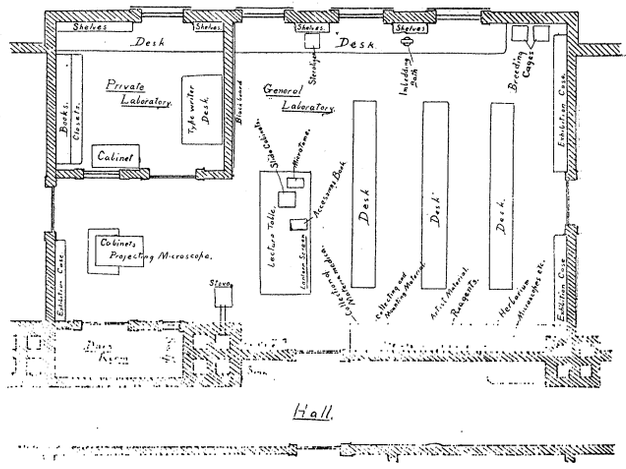
A LABORATORY OF PLANT DISEASES.

BY C. W. WOODWORTH, BERKELEY, CAL.

THERE has recently been equipped at the University of California a laboratory for the study of the subject of plant diseases in its broadest sense; and, as there are but few if any others where the whole subject is taught as a unit, it may be well to give an outline of the equipment for this class of work.

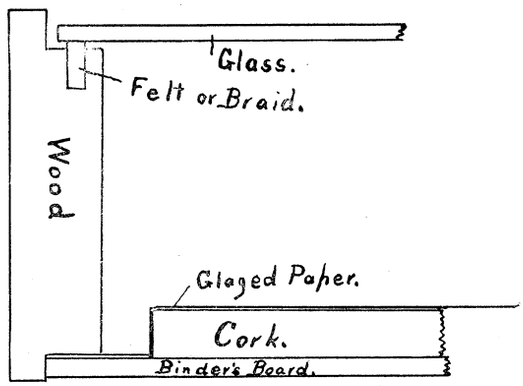
We will not consider that part of the equipment for this work afforded by the grounds, orchard, nursery, gardens, and greenhouses of the agricultural department, but confine ourselves to the laboratory proper. The subject of plant diseases is now, and will continue to be, associated with that of entomology, so that the same equipment, to a considerable extent, serves for the two subjects.

The laboratory-room is something over twenty by thirty feet, and is situated on the north side of the Experiment Station building. It is lighted by four windows, having an entirely unobstructed view, and so giving ample light for microscope work. A corner of the room is partitioned off for a private laboratory, and a closet is fitted with a ruby window, affording an opportunity for photo and blue-print work. The figure below will give a good idea of the arrangement of the room.



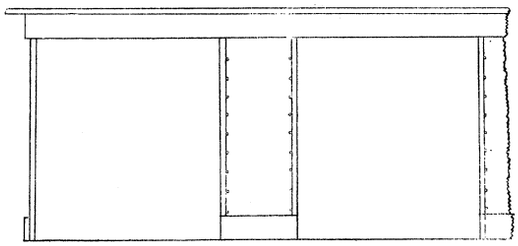
The windows are all fitted with heavy shades working in grooves, enabling one to darken the room very easily and quickly when the lantern is to be used for illustration. The views are projected on a screen of tracing-cloth, which is mounted on an ordinary spring-roller and is ordinarily rolled up out of the way.

Besides the benches near the windows, which are used by advanced students, there are also three long desks, one and a half feet wide by twelve in length, that have proven themselves so convenient that a sketch of one is presented. As can be seen on the plan, these are so constructed that at the side of each student boxes, the size of those of the collection, may be used as drawers, or boards may be inserted forming shelves.



The boxes used for the collection are made as shown in the accompanying figure, and are from their peculiar construction not liable to warp or crack, and so remain perfectly insect-proof.

The cloth bearing for the glass is treated with corrosive sublimate, and the paste and glue used are arseniated. These boxes are kept in cabinets, the glass doors of which are fitted with a rabbited groove on all four sides, thus making them also dust- and insect-proof.



The collections kept in these cabinets are arranged in three series. Series one is the systematic collection, where the organisms producing injuries to plants are grouped in the ordinary order, beginning with mammals and ending with the higher plants. The second series is the "host" collection, where the various plants are taken up in an agricultural order, as, for instance, seed crops, fruit crops, etc., and the injuries to each particular crop illustrated. In the third series, the symptomatic collection, all diseases having a common symptom are brought together, thus all galls and distortions from whatever cause or on whatever plant are assembled and classified.

Besides these there are the beginnings of a cryptogamic herbarium in drawers and a collection representing the materia medica of plant diseases.

There are in the laboratory a sterilizer and all the other necessary apparatus for this class of bacteriological work. For microscopical and histological work there is also a good equipment including paraffin bath, microtome suitable for the highest grade of work, compound microscopes and accessories, and a very good outfit of reagents.

All reagents, as far as possible, are kept in standard strengths, and the bottles marked to serve as graduates for dilution. Thus the chromic acid is made up in a large bottle into a 5 per cent solution. The 1 per cent solution is made by filling the bottle to contain it to a mark and adding water. Most of the chromic mixtures are made from the one per cent. The chromic-acetic killing mixture, for instance, is made, as is indicated on the label, from one-half per cent chromic acid to the first mark, 95 per cent alcohol to the second, and 10 per cent acetic acid to the neck. Mixtures liable to deteriorate are kept in small bottles, and such as the acid-alcohols for decolorizing are not kept mixed at all, but large homo vials are properly labelled and the mixtures made up as used.

This sketch gives merely the present condition of the laboratory, it is expected that apparatus will be added from time to time as opportunity offers and as it is needed for the work in hand; indeed, there is considerable new apparatus at the present time being constructed for the laboratory.

AN IMPORTANT COLLECTION OF MOLLUSCA.

BY HENRY A. PILSBRY, ACAD, NAT. SCI., PHILADELPHIA.

IT is not generally known, even among specialists, that one of the most valuable and most instructively arranged collections of Mollusca in America, is that which Professor Henry A. Ward has brought together at Rochester, N.Y. This collection the writer has recently had an opportunity to examine, and it is believed that some account of it may be useful not only to specialists in Mollusk morphology, or conchologists desiring to see rare shells, but also to those who look upon a collection especially as an instrument of education for class or public use.

The primary idea of Professor Ward's collection is to give the spectator not only a comprehensive but a *comprehensible* view of all phases of Mollusk life; and to this end a number of the more typically developed forms of each genus have been selected for exhibition. The practical advantage in limiting the number of species representing each genus will be readily admitted by those who have observed the effect, on the non-scientific observer, of the vast wilderness of similar species exhibited in some of the public museums of our large cities.

A further purpose has been to procure the best specimens obtainable of each species represented, and to select not merely the rare and beautiful, but, before all, species and specimens which have a life history worth knowing, and can tell it themselves.

The dry specimens of shells are contained in horizontal glazed cases disposed around the sides of two rooms,—in all, about 220 linear feet of cases. Wall-cases behind them contain alcoholic Mollusks, and drawers below hold additional species. The specimens are mounted upon light wooden tablets, appropriately colored, and made by gluing two pieces together, crossing the grain to prevent warping. Labels for families and higher groups are printed, and in most cases contain a concise statement of the fundamental characters of the group. The shellless forms, such as most Cephalopods and the *Nudibranchiata* are represented by Blatschka's beautiful models, now, alas! no longer obtainable.

A few hasty notes upon some of the specimens may be of interest. Upon entering the outer room one sees suspended from the ceiling a life-size model of the gigantic Squid (*Architeuthis*) of the North Atlantic, its suckered tentacular arms thirty feet in length. The actual existence of such monsters almost makes us forgive old Denys de Montfort for his picture of a "Poulpe Colossal" dragging down a full-rigged ship! The first horizontal cases contain shells of the Paper Nautilus; then several species of the Chambered Nautilus. A specimen of the animal of the latter (*Nautilus pompilius*) in its shell is one of a very few in America; though the shells are not uncommon, this remnant of a Palæozoic and Mesozoic race is rarely found in the flesh. The pelagic Pteropods are arranged after the Cephalopods, and then the air-breathing Gastropods. The latter series begins with carnivorous forms, the worm-eating genus *Testacella*, in which the shell is degenerate, owing to its subterranean habits, standing first,[1] followed by the Floridian *Glandina*, which has a well-developed shell, and subsists largely upon snails, swallowing them whole and digesting the soft parts out of the shells at leisure. Following these are the Achatinas of Africa, largest of land snails. The striped, oval shells are 8 or 9 inches long. With them are specimens of their eggs, hitherto, I believe, undescribed. They are about the size of a sparrow's egg, oval, with calcareous shell, and of a bright sulphur-yellow color; the only case known to me of a land snail having colored eggs.

In an adjacent case are the South American Bulimi, *Tomigerus* and *Anostoma*, having upturned apertures. An Amazonian Indian who collected them said to Professor Ward, "God laughed when he made these shells."

The numerous families of marine gastropods are represented by characteristic specimens, among them a good number of species which, to my knowledge, are not in any other American museum. The families *Volutidæ*, *Conidæ*, and *Muricidæ* may be mentioned as affording valuable material. An example of *Xenophora conchyliophora* carried a load of rounded pebbles soldered to his shell instead of the usual disguise of shells and shell-fragments, obviously showing the character of the sea-bottom he lived upon, and an ability to adapt himself to unusual circumstances.

In the *Turbinidæ* we examined the unique type of *Astralium Wardii* Baker, and incline to consider it a form of *A. Japonicum* Dkr. It will be of interest to conchologists to learn that the hitherto unknown operculum of *A. modestum* Rve. of Japan is represented by several specimens, and that it proves to be of the same abnormal type as that of the Mediterranean species, *A. rugosum*, the form and the position of the nucleus being the same in both. The operculum of *A. modestum*, however, is pure white, while that of the other species is scarlet.

The series of Lamellibranchiata is of equally great extent. But further enumeration would be tedious. We may confidently state that those interested in science-education or in animal life-history and structure will find, as the writer has done, that this collection is full of most valuable suggestions and material, and will well repay a visit to Rochester.

[1] The writer has recently shown that the South African genus *Aerope* is more highly specialized than any other carnivorous land-snail, and it should therefore be given first place in the series.